



John F. Kennedy Space Center

EXPENDABLE LAUNCH VEHICLES

# Discovery Program Workshop

## *ELV Launch Services*

**Darrell Foster**  
**ELV Mission Management Office**

**July 24, 2002**



# NASA/KSC ELV Program

- **Charter: Provide commercially available ELV launch services acquisition and management for NASA missions and customers.**
  
- **Objectives: to ensure ELV mission success, provide the lowest cost services on-time, and maximize customer satisfaction**
  
- **Primary Functions:**
  - **ELV Launch Services Contract acquisition/management**
  - **ELV Budget development/execution**
  - **Mission Integration Management – “cradle-to-grave”**
  - **Core vehicle engineering, production, test, and operations insight**
  - **Mission Analysis & Design**
  - **Launch Site Integration Management**
  - **Communications/Telemetry**
  - **Advanced Missions Planning**
  - **Mission Assurance**

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**HUNT BCH RO (VB-A8-B)**  
LEAD - M. HALLETT (Dual Function)  
T. NGUYEN  
**SECY** C. RENFRO  
**CHANDLER RO (VB-A8-C)**  
LEAD - W. WESTHOFF  
**VAFB RO (VB-A8-D)**  
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**VB-E2 LAUNCH SITE INTEGRATION BRANCH**

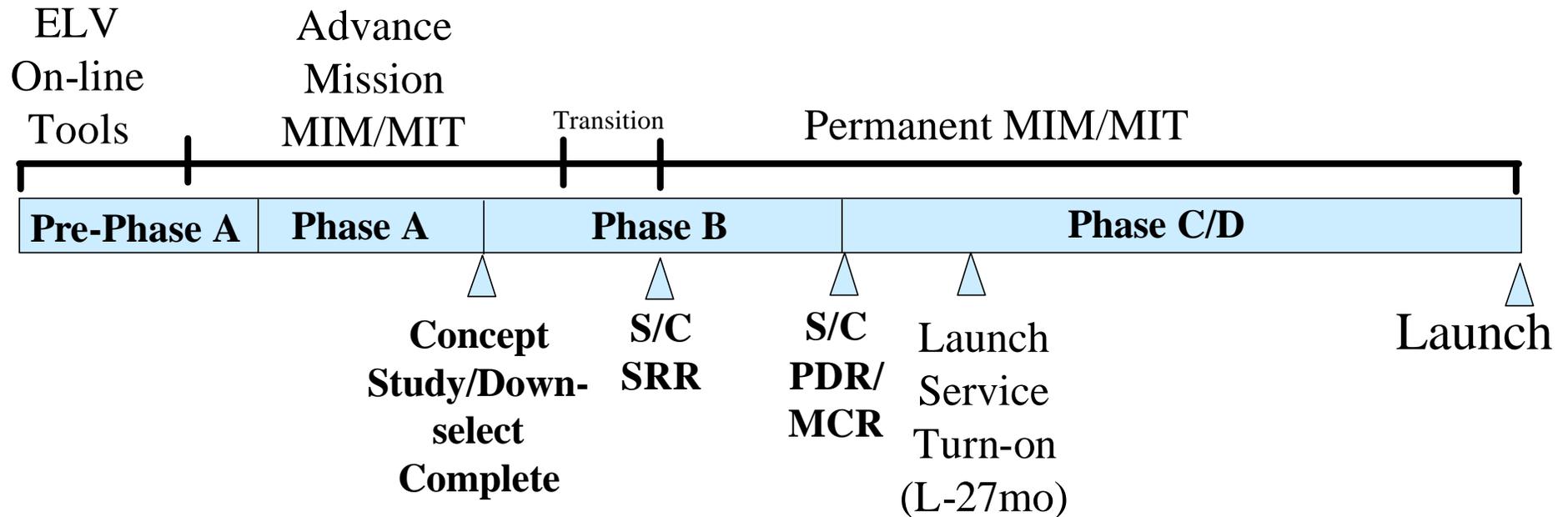
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# KSC ELV Involvement in Your Mission

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# Advance Mission Planning/Design

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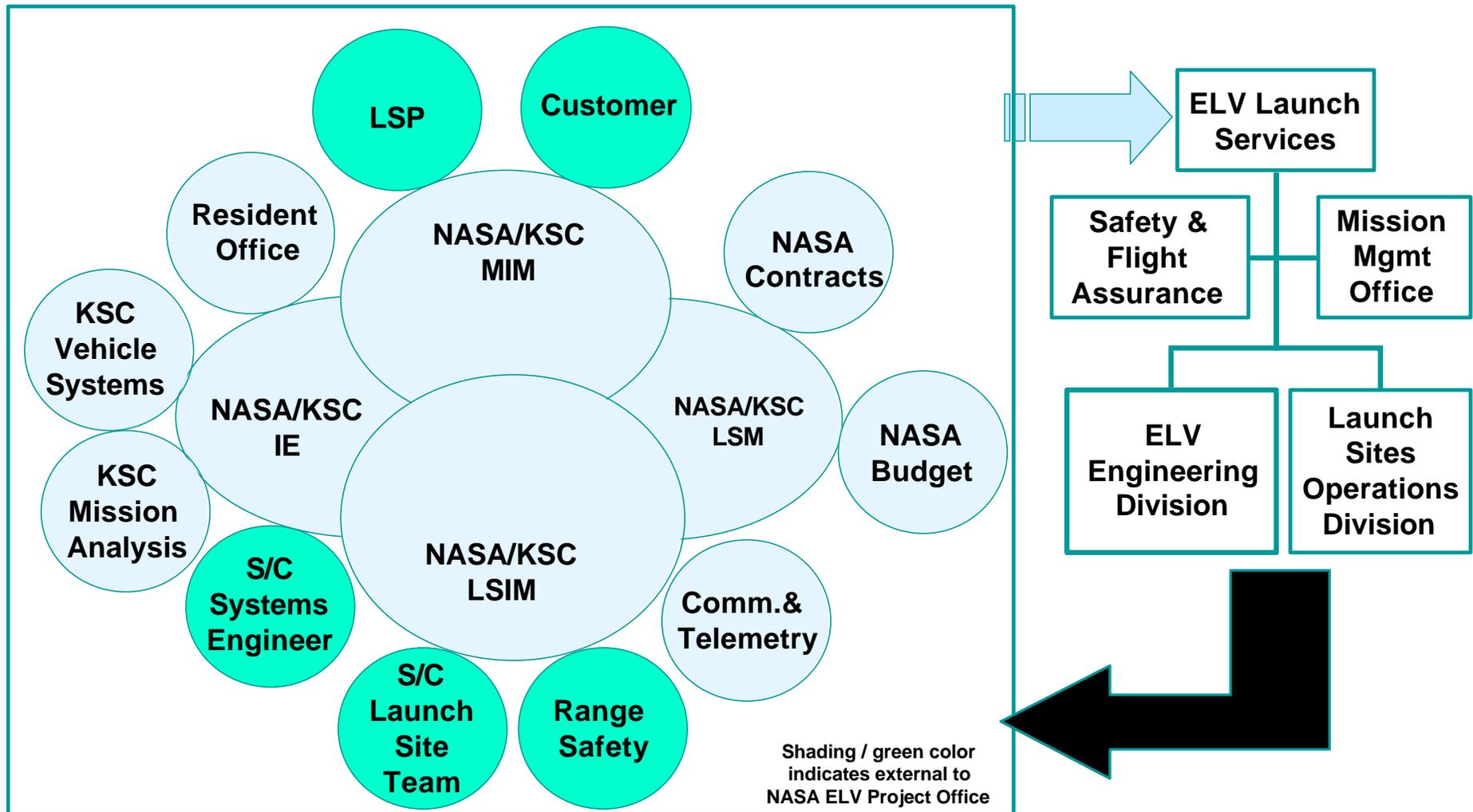
- **Advance Missions Team**
  - Mission Mgmt Office – Lead – Darrell Foster
  - Integration Engineering – Jim Robinson
  - Mission Analysis – Mike Carney
  - Program Integration Office
- **Provide a Focal Point into the ELV Org**
  - Customer Relations and Future Business Development
- **Support to Mission Formulation Team in performing LV trades**
  - Cost & Performance Quotes
  - Directed Missions
  - Potential Missions
  - Agency Initiatives
- **AO development, consultation, and evaluation**
- **Support to Independent Assessment Review Teams**
- **Work with the Launch Service Providers**
  - Future Business
  - Advance Mission Studies
- **Development/maintenance of on-line tools**
  - ELV Performance Web page
  - On-line Planner's Guide



# Mission Integration Team

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## Insight & Approval (per NPD 8610.23)

- The following are examples of the types of information/documentation that KSC/ELV has approval (oversight) of and insight (audit) of.
- NPD 8610.23 specifies these items as a minimum and is written in to EVERY launch service Contract for NASA missions – this is the hook.
- **Specific areas requiring government approval is focused on the interface with the spacecraft:**
  - S/C to LV ICD's documents and drawings
  - Resolution/closeout of MIWG, MRR and FRR action items
  - Mission unique hardware/software design, analysis, manufacture, and test
  - Top level test plans, requirements, and success criteria for Integrated Vehicle Systems and for tests that verify the integrated vehicle interfaces
  - Spacecraft handling procedures and deviations
  - Integrated S/C to LV mate, test and closeout procedures, as run procedures and deviations
  - Anomaly resolutions that affect the integrated S/C to LV assembly
  - Launch commit criteria and Launch Go/No-Go
- **Specific areas open to government insight:**
  - Baseline vehicle design, analyses, and configuration management
  - Production, including reviews, plans, schedules, tests, post test data and MRB's, Critical flight hardware pedigree
  - Major system and integrated systems tests
  - Post test data, anomaly resolution/closeout, failure analysis,
  - Launch site schedules, plans, vehicle preparation, closeout data, walkdowns, operations and procedure discipline
  - Post launch data and anomaly investigations/closeouts



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# Launch Vehicles on Contract



# NASA Launch Services – The Boeing Company

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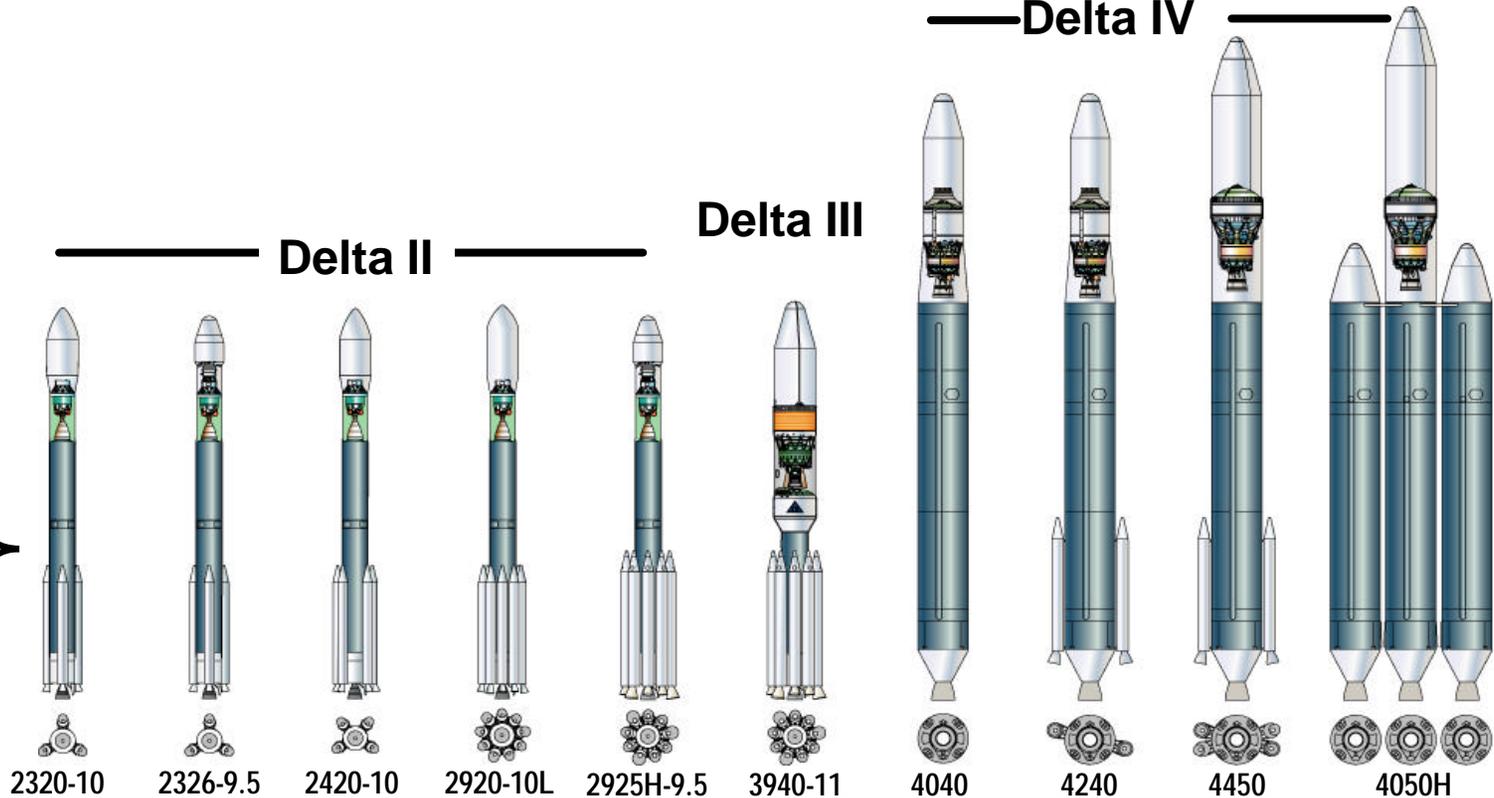
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Delta IV

Delta II

Delta III

This selection of LV configurations is only a sample set of those available on the NLS Contract – other configurations are available – see contact info below for further details



Est. Cost <sup>1</sup> (FY'01 \$)	\$53M - \$58M			\$61M - \$65M	\$67M - \$72M	\$81M - \$86M	\$87M - \$107M			\$150M - \$160M	
<b>Generic LV Performance<sup>2</sup> (kg):</b>											
LEO (500km, 28.5deg)	2,460	N/A	2,855	4,450	N/A	7,640	8,690	11,575	13,100	23,165	
SSO (500km)	1,755	N/A	2,120	3,305	N/A	N/A	6,915	9,410	10,930	21,040	
GTO (35,788km, 28.5deg)	N/A	925	N/A	N/A	2,170	3,690	3,985	5,630	6,345	12,650	
High Energy	$C_3 = 0 \text{ km}^2/\text{s}^2$	N/A	600	N/A	N/A	1,525	2,625	2,735	4,075	4,580	9,305
	$C_3 = 10 \text{ km}^2/\text{s}^2$	N/A	490	N/A	N/A	1,235	2,095	2,115	3,275	3,685	7,810

<sup>1</sup>NOTE: All prices are estimated in FY 2001 dollars (order year = L-27) based on current contracts or publicly disclosed information. Actual prices may vary based on market conditions, competitive negotiations, and mission unique requirements. Price ranges include a nominal allocation for Mission Unique options/peculiar services and a nominal Spacecraft Launch-Site Processing and Telemetry Support Cost. Figures do not include efforts to support flying Dual Payload Configurations, nuclear materials, major modification costs, or Western Range Launches. Escalation figures for outyears (2002-2003) are approximately 4% cumulative. FOR BUDGET PLANNING PURPOSES FOR AO/FUTURE STUDIES.

<sup>2</sup> NOTE: These are generic performance figures; mission-unique requirements may impact/decrease maximum performance capability.

For further information on NASA Launch Services, please contact Darrell Foster, NASA/KSC ELV Mission Management Office, 321-476-3622, darrell.foster-1@ksc.nasa.gov



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# NASA Launch Services

## Lockheed Martin Commercial Launch Services

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Atlas III		Atlas V					
							
<b>AIII-B</b>	<b>40X</b>	<b>50X</b>	<b>51X</b>	<b>52X</b>	<b>53X</b>	<b>54X</b>	<b>55X</b>
							

**Numbering Scheme:**  
 1<sup>st</sup> digit: 4 = 4m Fairing  
 5 = 5m Fairing  
 2<sup>nd</sup> digit: # of Strap-on Solid Rocket Boosters  
 3<sup>rd</sup> digit: 1 = (SEC) Single Engine Centaur  
 2 = (DEC) Dual Engine Centaur

Est. Cost <sup>1</sup> (FY'01 \$)	\$92M - \$97M	\$96M - \$101M	\$104M - \$124M					
Generic LV Performance <sup>2</sup> (kg):	SEC/DEC							
LEO (500km, 28.5deg)	7,365/9,600	9,445/11,500	9,540 (DEC)	9,880/11,490	12,180/13,735	14,045/15,840	15,715/17,450	17,145/18,910
SSO (500km)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
GTO (35,788km, 28.5deg)	4,015/4,390	4,765 (SEC)	3,880 (SEC)	5,175 (SEC)	6,180 (SEC)	7,105 (SEC)	7,880 (SEC)	8,570 (SEC)
High Energy	$C_3 = 0 \text{ km}^2/\text{s}^2$ 2,975/3,180	3,445 (SEC)	2,680 (SEC)	3,765 (SEC)	4,545 (SEC)	5,210 (SEC)	5,820 (SEC)	6,330 (SEC)
	$C_3 = 10 \text{ km}^2/\text{s}^2$ 2,450/2,580	2,840 (SEC)	2,150 (SEC)	3,100 (SEC)	3,765 (SEC)	4,345 (SEC)	4,865 (SEC)	5,300 (SEC)

<sup>1</sup> NOTE: All prices are estimated in FY 2001 dollars (order year = L-27) based on current contracts or publicly disclosed information. Actual prices may vary based on market conditions, competitive negotiations, and mission unique requirements. Price ranges include a nominal allocation for Mission Unique options/peculiar services and a nominal Spacecraft Launch-Site Processing and Telemetry Support Cost. Figures do not include efforts to support flying Dual Payload Configurations, nuclear materials, major modification costs, or Western Range Launches. Escalation figures for outyears (2002-2003) are approximately 4% cumulative. FOR BUDGET PLANNING PURPOSES FOR AO/FUTURE STUDIES.

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# Small Expendable Launch Vehicles KSC Orbital Sciences Corporation

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## Pegasus XL



## Taurus



	PegasusXL	Taurus				
		2110	2210	2130	2230	
Est.Cost <sup>1</sup> (FY'01 \$)	\$23M - \$27M	\$38M - \$40M		\$44M - \$46M		
Generic LV Performance <sup>2</sup> (kg):						
LEO (500km, 28.5deg)	365	1,190	1,010	N/A	N/A	
SSO (500km)	255	850	670	N/A	N/A	
GTO (35,788km, 28.5deg)	N/A	N/A	N/A	N/A	N/A	
High Energy						
	C <sub>3</sub> = 0 km <sup>2</sup> /s <sup>2</sup>	N/A	N/A	N/A	295	245
	C <sub>3</sub> = 10 km <sup>2</sup> /s <sup>2</sup>	N/A	N/A	N/A	225	185

**Numbering Scheme:**  
**1<sup>st</sup> digit: Vehicle Config.**  
 2 = Commercial Taurus  
**2<sup>nd</sup> digit: Fairing**  
 1 = 63"  
 2 = 92"  
**3<sup>rd</sup> digit: Stage 3**  
 1 = Orion-38  
 3 = Star-37  
**4<sup>th</sup> digit: stage 4**  
 0 = none  
 (currently no 4-stage options on-Contract)

<sup>1</sup> NOTE: All prices are estimated in FY 2001 dollars (order year = L-27) based on current contracts or publicly disclosed information. Actual prices may vary based on market conditions, competitive negotiations, and mission unique requirements. Price ranges include a nominal allocation for Mission Unique options/peculiar services and a nominal Spacecraft Launch-Site Processing and Telemetry Support Cost. Figures do not include efforts to support flying Dual Payload Configurations, nuclear materials, major modification costs, or Western Range Launches. Escalation figures for outyears (2002-2003) are approximately 4% cumulative. FOR BUDGET PLANNING PURPOSES FOR AO/FUTURE STUDIES.

<sup>2</sup> NOTE: These are generic performance figures; mission-unique requirements may impact/decrease maximum performance capability.



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# Other Hot Topics in ELV



# Hot Topics

- **Commercial Market (or lack thereof) effects on NASA Launch Service Providers**
  - Block-buy of Medium-class LVs
  - Exploring the ability to fly STS Secondary payloads on small-class ELVs
  - Exploring inter-Agency needs
- **New NASA Policy - Commercialization of PPF**
- **ELV Engineering Support contract recompetition/transition**
- **ELV Certification Efforts (Delta/Atlas III and Delta IV/Atlas V) on-going**
  - resource drain
- **NLS solicitation for the Mars'05 (MRO) launch service awarded to ILS/LMA Atlas III**
- **Potential for NLS solicitation for New Horizons launch service later in the year to support '06 launch opportunity**